REMARKS

Claims 1-20 are pending in the current application. Claims 1 and 4 are independent claims. In view of the above amendments and following remarks, favorable reconsideration and allowance of the present application is respectfully requested.

I. ALLOWABLE SUBJECT MATTER

Applicant with to thank the Examiner for the indication that claims 4-5 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

By the present Amendment, Applicant submits that claim 4 has been rewritten into independent form including all the limitations of claim 1, from which claim 4 previously depended. In addition, claims 6, 9-12, 19 and 20 have been amended to depend from claim 4.

Thus, Applicant submits that amended claim 4, and claims 5-12, 14, 19 and 20 at least by virtue of their dependency on claim 4, are in condition for allowance.

Furthermore, Applicant submits that independent claim 1, and claims 3, 13 and 15-18 at least by virtue of their dependency on claim 1, are allowable at least for the reasons discussed below.

II. CLAIM AMENDMENTS

By the present Amendment, Applicant submits that independent claim 1 has been amended to include similar limitations as previously recited in claim 2. Thus, Applicant submits that the amendments to claim 1 do not introduce new matter or raise new issues.

III. EXAMPLE EMBODIMENTS

Example embodiments teach that an artificial lipid bilayer membrane may be formed by applying a lipid solution, obtained by dispersing a phospholipid in an organic solvent, on an opening. The lipid solution is applied by means of a negative pressure that comes into contact with a support layer, causing the lipid solution to become thinner. The artificial lipid bilayer membrane is a thin layer made of a lipid solution, which is different from a cell membrane of a biological cell.

Example embodiments teach that the artificial lipid bilayer membrane has problems in terms of stability. That is, if the artificial lipid bilayer membrane is formed on a support layer made of polymer gel, the artificial lipid bilayer membrane is unstable in a direction parallel to the bottom of the upper solution chamber (see direction of the arrow in Fig. 12 of the instant Specification), making it is difficult to keep the curvature of the artificial lipid bilayer membrane. If the artificial lipid bilayer membrane and the cyclic bulk phase are physically and chemically unbalanced, then the artificial lipid bilayer membrane breaks.

Other example embodiments teach that reducing the pressure in the lower solution chamber allows the formation of an artificial lipid bilayer membrane that is stable in a direction parallel to the bottom of the upper solution chamber and maintains a curvature of the artificial lipid bilayer membrane.

IV. CITED ART GROUNDS OF REJECTION

Claims 1, 6-12, 14, 19 and 20 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Toru Ide et al. (hereinafter "Ide"), "An Artificial Lipid Bilayer Formed on An Agarose-Coated Glass for Simultaneous Electrical And Optical Measurement of Single Ion Channels," in view of Vogel et al. (hereinafter "Vogel"), U.S. Patent No.

7,201,836; and claims 2-3, 13 and 15-18 stand rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Ide in view of Vogel and in further view of Rubinsky et al. (hereinafter "Rubinsky"), U.S. Patent No. 6,300,108. Applicant respectfully traverses the rejections.

A. INDEPENDENT CLAIM 1

Independent claim 1 has been amended to recite a current measuring device including (*inter alia*) a negative pressure generation means that "causes the artificial lipid bilayer membrane formed on the membrane formation opening of the upper solution chamber to swell to a side of the lower solution chamber so as to cause the artificial lipid bilayer membrane to be thinner and to come into contact with the support layer so that the artificial lipid bilayer membrane is supported on the support layer." Non-limiting, example embodiments may be found throughout the Specification. Applicant submits that the art relied upon by the Examiner fails to teach, or suggest, the above features recited in amended independent claim 1.

i. RUBINSKY

Acknowledging the deficiencies of Toru and Vogel, the Examiner relies on Rubinsky to teach a "negative pressure generation means" as recited in amended independent claim 1. However, Applicant submits that the combination is improper for the following reasons.

Rubinsky relates to a microdiffusion apparatus, for a single biological cell, for transporting materials across a cell membrane and a microelectroporation apparatus for a single biological cell. The microelectroporation apparatus of Rubinsky is used to transport chemical materials across a cell membrane of a single biological cell without application of

an electrical field. The single biological cell is retained in a position over the opening between two chambers, and materials diffuse across the cell membrane of the biological cell. See column 5, line 66 to column 7, line 5 of Rubinsky. Applicant submits that the microdiffusion apparatus of Rubinsky is irrelevant to the artificial lipid bilayer membrane.

Furthermore, the microelectroporation apparatus of Rubinsky is used for electroporation in which a pore is formed by an electrical pulse in a single biological cell retained in a position over the opening between two chambers. A chemical species is infused in the biological cell through the pore. Thus, the microelectroporation apparatus of Rubinsky is different from example embodiments.

Applicant submits that the artificial lipid bilayer membrane taught by Rubinsky is different in terms of structure and strength. In Rubinsky, the already-formed lipid bilayer membrane (*i.e.,* the living cell) is retained on an opening in order to allow diffusion or electroporation. The cellular membrane of the already-formed lipid bilayer membrane (the living cell) is made of membrane protein, in addition to a lipid bilayer. Thus, Applicant submits that the cellular membrane of the already-formed lipid bilayer membrane (the living cell) is different from an artificial lipid bilayer membrane made of only lipids. Furthermore, because the cell membrane of the living cell does not include an organic solvent, it is unnecessary to make the cell thinner, contrary to example embodiments.

In addition, Rubinsky discloses that a cell with a typical diameter of 20 microns in the upper solution chamber is drawn and retained on the opening with a diameter of 4-5 microns by reducing the pressure in the lower solution chamber. Thus, not only is Rubinsky irrelevant to an artificial lipid bilayer membrane, the negative pressure in Rubinsky is applied in order to retain a vesicle or cell on the opening or preventing a current from leaking out between the opening and the membrane,.

ii. THE COMBINATION OF IDE, VOGEL AND RUBINSKY

Applicant notes that Vogel is directed to a system for positioning and analyzing samples for electrical and/or optical analysis. Vogel discloses retaining an already-formed lipid bilayer membrane (*e.g.*, a vesicle and a cell that do not include an organic solvent) on an opening. Thus, similar to Rubinsky, Vogel does not relate to an artificial lipid bilayer membrane.

Furthermore, acknowledging the deficiencies of Ide and Vogel, the Examiner relies on Rubinsky and states,

> A person of ordinary skill in the art would find it obvious at the time the invention was made to further modify Toru Ide et al. in view of Vogel et al. to dispose in the interval keeping member or at any other convenient places, a negative pressure generation means that includes a suction port and a sucking means, as taught by Rubinsky et al., for the purpose of controlling the movement of the biological cells in the lipid bilayer membrane by controlling the internal pressure of the lower solution chamber and causing the artificial lipid bilayer membrane formed on the membrane formation opening of the upper solution chamber to swell to the side of the lower solution chamber much faster and in a controlled manner as compared to the natural process (col. 7, lines 53-56)."
>
> Action, p. 7 (emphasis added).

However, Applicant disagrees for the following reasons.

Applicant submits that the "negative pressure generation means" recited in claim 1 does not relate to biological cells or "controlling the movement of the biological cells" as asserted by the Examiner. That is, in the claimed current measuring device, the artificial lipid bilayer measures an ion current of an ion channel after the formation of the artificial lipid bilayer membrane, as shown in attached drawings labeled "Appendix A."

As described in Example 1, "...a cell membrane vesicle sampled from a bovine tracheal plain muscle was fused with the artificial lipid bilayer membrane 2, thereby

inserting a K^+ channel on the vesicle membrane into the artificial lipid bilayer membrane 2..." Specification, p. 38, ll. 13-17.

Thus, Applicant submits that the negative pressure generation means drops an internal pressure of the lower solution chamber in order to form an artificial lipid bilayer membrane that is stable in a direction parallel to the bottom of the upper solution chamber and that strictly keeps a curvature of the artificial lipid bilayer membrane as taught by example embodiments. For example, see page 45, lines 15-19 of the instant Specification.

In Ide, the artificial lipid bilayer membrane is swollen toward the lower solution chamber by increasing the pressure in the upper solution chamber. Thus, Applicants submit that it would not have been obvious to one skilled in the art to stabilize an artificial lipid bilayer membrane using a "negative pressure generation means" in the manner recited in claim 1.

Accordingly, Applicant submit that Ide and Vogel in view of Rubinsky fails to teach, or suggest, a negative pressure generation means that "causes the artificial lipid bilayer membrane formed on the membrane formation opening of the upper solution chamber to swell to a side of the lower solution chamber so as to cause the artificial lipid bilayer membrane to be thinner and to come into contact with the support layer so that the artificial lipid bilayer membrane is supported on the support layer" as recited in amended independent claim 1.

As such, Applicant respectfully requests that the Examiner reconsider and withdraw the rejection to amended independent claim 1, and claims 3, 13 and 15-18 at least by virtue of their dependency on independent claim 1.

C. INDEPENDENT CLAIM 4

Claim 4, which has been amended into independent form, is directed to a current measuring device including (*inter alia*) "an interval keeping member for keeping a predetermined interval between the upper solution chamber and the bottom plate." As acknowledged by the Examiner, "...none of the art discloses a current measuring device comprising an interval keeping member capable of changing an interval between an upper chamber and a bottom plate, the change of the interval causes an artificial lipid bilayer membrane to swell to the side of the lower solution chamber, and in the combination as claimed." Action, p. 8.

For at least the reasons discussed above, Applicant submits that amended independent claim 4, and claims 5-12, 14, 19 and 20 at least by virtue of their dependency on claim 4, is allowable over the cited art.

CONCLUSION

Accordingly, in view of the above, reconsideration of the rejections and allowance of each of claims 1-20 in connection with the present application is earnestly solicited.

Should there be any matters that need to be resolved in the present application; the Examiner is respectfully requested to contact the undersigned at the telephone number below.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 08-0750 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

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Attachments: Appendix A (one (1) sheet)